

CLAIMS

1. An intake air amount variation detector for detecting intake air amount variations among cylinders of a multiple-cylinder internal combustion engine, the device comprising:

injection amount control means for changing a fuel injection amount from an injection amount for stoichiometric operation to either an increased amount or a decreased amount;

computation means for determining the amount of a torque or rotation speed change that occurs when the fuel injection amount is changed by the injection amount control means; and

output means for outputting the torque or rotation speed change amount determined by the computation means as an index value that indicates the degree of intake air amount variations among the cylinders.

2. The intake air amount variation detector according to claim 1, further comprising:

comparison means for comparing a predetermined reference value with the amount of a change that occurs when the injection amount control means increases the fuel injection amount from the injection amount for stoichiometric operation; and

judgment means, which, when the amount of the change is greater than the reference value, judges that a permissible level is exceeded by the intake air amount variations among the cylinders.

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3. The intake air amount variation detector according to claim 1, further comprising:

comparison means for comparing a predetermined reference value with the amount of a change that occurs
10 when the injection amount control means decreases the fuel injection amount from the injection amount for stoichiometric operation; and

judgment means, which, when the amount of the change is smaller than the reference value, judges that a
15 permissible level is exceeded by the intake air amount variations among the cylinders.

4. The intake air amount variation detector according to any one of claims 1 to 3, wherein the
20 injection amount control means periodically increases or decreases the fuel injection amount from the injection amount for stoichiometric operation by a predetermined amount; and wherein the computation means extracts a change component having the same frequency as a fuel
25 injection amount change frequency from a torque or

rotation speed change, and determines the amplitude of the extracted change component as the amount of the change.

5. An intake air amount variation detector for
5 detecting the intake air amount variations among cylinders of a multiple-cylinder internal combustion engine, the device comprising:

injection amount control means for changing a fuel injection amount for a particular one of the cylinders
10 from an injection amount for stoichiometric operation to either an increased amount or a decreased amount;

computation means for determining the amount of a torque or rotation speed change that occurs when the fuel injection amount for the particular cylinder is changed by
15 the injection amount control means; and

output means for outputting the torque or rotation speed change amount determined by the computation means as an index value that indicates the degree of intake air amount variation in the particular cylinder.

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6. The intake air amount variation detector according to claim 5, further comprising:

comparison means for comparing a predetermined reference value with the amount of a change that occurs
25 when the injection amount control means increases the fuel

injection amount for the particular cylinder from the
injection amount for stoichiometric operation; and

judgment means, which, when the amount of the
change is greater than the reference value, judges that a
5 permissible level is exceeded by an undue increase in the
intake air amount in the particular cylinder.

7. The intake air amount variation detector
according to claim 5, further comprising:

10 comparison means for comparing a predetermined
reference value with the amount of a change that occurs
when the injection amount control means decreases the fuel
injection amount for the particular cylinder from the
injection amount for stoichiometric operation; and

15 judgment means, which, when the amount of the
change is smaller than the reference value, judges that a
permissible level is exceeded by an undue decrease in the
intake air amount in the particular cylinder.

20 8. The intake air amount variation detector
according to any one of claims 5 to 7, wherein the
injection amount control means periodically increases or
decreases the fuel injection amount for the particular
cylinder from the injection amount for stoichiometric
25 operation by a predetermined amount; and wherein the
computation means extracts a change component having the

same frequency as a fuel injection amount change frequency for the particular cylinder from a torque or rotation speed change, and determines the amplitude of the extracted change component as the amount of the change.

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9. An intake air amount variation detector for detecting the intake air amount variations among cylinders of a multiple-cylinder internal combustion engine, the device comprising:

10 injection amount control means for changing a fuel injection amount from an injection amount for stoichiometric operation to either an increased amount or a decreased amount;

computation means for determining, on an individual
15 cylinder basis, the amount of a torque or rotation speed change that occurs when the fuel injection amount is changed by the injection amount control means; and

output means for outputting the torque or rotation speed change amount determined by the computation means as
20 an index value that indicates the degree of intake air amount variation in an individual cylinder.

10. The intake air amount variation detector according to claim 9, further comprising:

25 comparison means for comparing, on an individual cylinder basis, a predetermined reference value with the

amount of the change that occurs when the injection amount control means increases the fuel injection amount from the injection amount for stoichiometric operation; and

judgment means, which, when the amount of the
5 change is greater than the reference value, judges that a permissible level is exceeded by an undue increase in the intake air amount in an individual cylinder.

11. The intake air amount variation detector
10 according to claim 9, further comprising:

comparison means for comparing, on an individual cylinder basis, a predetermined reference value with the amount of the change that occurs when the injection amount control means decreases the fuel injection amount from the
15 injection amount for stoichiometric operation; and

judgment means, which, when the amount of the change is smaller than the reference value, judges that a permissible level is exceeded by an undue decrease in the intake air amount in an individual cylinder.

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12. The intake air amount variation detector according to any one of claims 9 to 11, wherein the injection amount control means periodically increases or decreases the fuel injection amount from the injection
25 amount for stoichiometric operation by a predetermined amount; and wherein the computation means extracts a

change component having the same frequency as a fuel injection amount change frequency from a torque or rotation speed change sampled on an individual cylinder basis, and determines the amplitude of the extracted
5 change component as the amount of the change in an individual cylinder.

13. An intake air amount variation detector for detecting the intake air amount variations among cylinders
10 of a multiple-cylinder internal combustion engine, the device comprising:

first injection amount control means for changing the fuel injection amount for a particular one of the cylinders from an injection amount for stoichiometric
15 operation to an increased amount;

first computation means for determining the amount of a torque or rotation speed change that occurs when the fuel injection amount for the particular cylinder is changed by the first injection amount control means;

20 second injection amount control means, which, when the torque or rotation speed change amount determined by the first computation means is not greater than a predetermined reference value, decreases the fuel injection amount for the particular cylinder from the
25 injection amount for stoichiometric operation;

second computation means for determining the amount of a torque or rotation speed change that occurs when the fuel injection amount for the particular cylinder is changed by the second injection amount control means; and

5 output means for outputting the torque or rotation speed change amount determined by the first computation means and the torque or rotation speed change amount determined by the second computation means as index values that indicate the degree of intake air amount variation in
10 the particular cylinder.

14. The intake air amount variation detector according to any one of claims 4, 8, and 12, wherein the injection amount control means periodically changes the
15 fuel injection amount at a frequency outside the range of human perception.

15. The intake air amount variation detector according to any one of claims 1 to 14, further
20 comprising:

conversion means for converting the intake air amount variations among the cylinders to intake valve operating angle variations among the cylinders and/or intake valve lift amount variations among the cylinders.